BOOK REVIEWS

Volcanoes. Robert Decker and Barbara Decker. 1989. W. H. Freeman and Co., New York, NY. 285 p. $14.95 cloth.

Volcanoes are wonderfully complex, dynamic systems that stretch human conceptions of scale. Far from being stone edifices that have always been and will always be as we see them, volcanoes are the tips of intricate, deep-rooted magma reservoirs; they are the gateways through which volcanic products build, replenish, and perturb the atmosphere and soil. Volcanoes erupt over familiar periods of hours to decades, but volcanic processes act over the range of microseconds to millions of years. The edifices come and go, torn apart by rain, gravity, and giant eruptions; but, more often than not, a new edifice grows in place of the old—adding a sense of life in our physical world.

This compact gem of a book captures not only the excitement of erupting volcanoes, but also the excitement of geologic processes that lead to and result from eruptions. Readers "see" these processes through instructive line drawings and a fine selection of color and black-and-white photographs. The book also conveys a sense of urgency: that advances in volcanology can help those who live near volcanoes to anticipate volcanic hazards and to move out of their way when necessary. The style is lively; the treatment of individual topics will appeal to most as ample and to others as an appetizer. A few will find treatments overly simplistic and will feel uncomfortable as the book stops short of indicating how much remains to be learned.

Vignettes of the birth of Surtsey, Iceland; the partial destruction of Mount St. Helens, Washington; and steady, spectacular growth of Kilauea, Hawaii, are nicely interleaved with general accounts of their respective tectonic settings. Examples from within the memory of most readers, including some as recent as 1988, help to convey the living nature of volcanology. The fact that most lethal eruptions since the first edition of *Volcanoes* in 1981 were from volcanoes not even listed in the 1981 list of "The World's 101 Most Notorious Volcanoes," is at once a concern and a promise—concern that some of the highest risk volcanoes are those which have been quiet for centuries, and promise that our understanding of dangerous volcanoes will improve during, if not before, each new eruption.

Volcanic volatiles (H_2O, CO_2, SO_2, H_2S, HCl, HF, and others) have received far less study than the solid products of volcanic eruptions, no doubt because of risk and technical difficulties in meaningful sampling. However, with a growing need to distinguish natural from anthropogenic controls on variability of our atmosphere and climate, studies of volcanic volatiles will be an exciting field. The pendulum on conventional wisdom has swung between a view that nearly all of our oceans and atmosphere originated from volcanoes and a view that volcanoes merely recycle volatiles; the truth is almost surely a hybrid of these views, varying with time scale, and is still under lively investigation. One frontier of these investigations is on the sea floor along mid-oceanic ridges, where most of the world's volcanic eruptions occur; another is in the continuous remote sensing of subaerial volcanic gases, from ground-based, aircraft-based, and space-based platforms. The topic of volcanic volatiles arises again in the chapter on geothermal energy, a relatively "clean" source of energy that may become increasingly attractive as nations try to manage the environmental and economic risks of dependence on fossil fuels.

The book concludes with a rightfully optimistic chapter on "Forecasting Volcanic Eruption." Most volcanoes give warning of their eruption—the challenges are to monitor volcanoes that are presently unwatched, to understand signs of unrest and, thus, to narrow uncertainties about the time, type, and magnitude of an impending eruption.

Decker and Decker's *Volcanoes* will delight a wide readership; it is the best volcano book on the market for the scientifically-curious nonspecialist. This volume is also a good bet for courses in introductory geology, even if it was not designed for that purpose. Volcanoes are interdisciplinary and lively, and the pairing of *Volcanoes* with one of the fine books about geologic time and evolution would make a powerful tool to interest students in the geosciences. Then, I expect, *Volcanoes* will stimulate some readers to dig more deeply into volcanology and to take on the challenges of improving forecasts of both eruptions and their atmospheric impacts.

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Mountain Environments: An Examination of the Physical Geography of Mountains. John Gerrard. 1990. The MIT Press, Cambridge, MA. 317 p. $25.00 hardcover.

This compact book is loaded with useful information that should prove beneficial to geologists, geographers, environmental scientists, and anyone interested in global change. Although the emphasis is on the physical environment, the biological component and the importance of the human factor in the geosystem are well covered. Mountains have received increased attention in the last decade as evidenced by the number of publications cited from this period (298, which is one third of the references in this book). This is deserved, given that 10% of the world's population live in mountain environments and 40% are dependent in some way on mountain resources. Because of the sensitivity of these landscapes, often they are subject to natural disasters which, in a period of accelerated global change, may experience changes in frequency, scale, and location.

Nine chapters follow a brief, but important, introduction. In Chapter 1, "The Nature of Distinctiveness of Mountains," Gerrard explores the range of definitions for mountains (there are many!), classification schemes, examples of mountain types, and details of mountain geomorphological systems. In such environments, destructional and constructional forces are in conflict; the discussion of denudation rates and controls is particularly helpful in understanding landscape change. Chapter 2 covers "Mountain Geoecology," which involves the

interaction of mountain topography, climate, soils, and vegetation. The purpose of this chapter is to provide an overview of the nature and components of mountain systems before examining the processes and landforms in detail. The interaction of mountain subsystems that are very dynamic, with steep ecological gradients and rapid movement of materials, animals, and energy, results in mountain zonation. Zonation systems are presented for tropical mountains, western cordillera of North America, the Himalayas, Japan, and Taiwan.

The next five chapters address a combination of processes and landscapes in mountains. Chapter 3, "Weathering and Mass Movement," has an excellent discussion of weathering and of some periglacial processes and landforms. A review of pertinent literature on mass movement helps to explain this process that is so important in mountain environments. The chapter on "Mountain Hydrology and River Processes" looks at the fluvial system, from production of water (including heat balance) through glacier runoff, floods, sediment loads, storage, and budgets to long-term changes in fluvial systems. The strength of the chapter "Slope Form and Evolution" is in the discussion of principles using examples from Iceland and Nepal Himalayas. Chapter 6, "Glaciation of Mountains," covers glacier classifications, dynamics, and landforms of glacial erosion. Although this chapter contains many "modern" diagrams that show such features as mass balance relationships and glaciated valley landsystems, the old diagram by W. M. Davis showing the before, during, and after phases of mountain glaciation is used here and still is appropriate. The distinctive elements of volcanic landscapes and processes are presented in "Volcanoes as Mountains." This chapter contains good accounts of types of volcanic mountains, weathering, mass wasting, and hazard assessment and mitigation.

In Chapter 8, "Mountains Under Pressure: Applied Physical Geography," Gerrard addresses the human factor in the geosystem; a factor that I believe is too often omitted. He notes that in developed countries, tourism and recreation are causing the problem; in developing countries, the pressure results from an overflow of people from the lowlands to the marginal uplands and mountains. He looks at the sensitivity and hazards of mountains, including those hazards from road building and timber harvesting, and approaches to designing hazard mapping projects. The final chapter, "Integration of Spatial and Temporal Mountain Systems—the Uncertainty Dilemma," brings in the uncertainty in understanding the systems, even in highly studied areas such as Colorado. Gerrard stresses the need for models of these complex systems where humans and natural systems interact, and reviews The Himalayan Environmental Degradation Theory to show the complexity of mountain systems.

The strengths of the book are its currency, comprehensive coverage, numerous references (>900), its useful summary diagrams and tables ranging from the intricate to the classic, and reasonable price. It succinctly provides an overview of our understanding of a complex and important part of the geosystem. Coverage of some topics may be too brief, which will force readers to seek out original literature. This is not a serious negative, particularly if the book is used as a text for an advanced geomorphology or environmental science course. The major negative of the book is the quality of the figures, which sometimes are dark and lack complete captions (limited explanations and too few locations); but this, in part, might have been a sacrifice to space. This book is probably not suited for the typical geomorphology course, but it should be read by those teaching geomorphology, physical geology, and environmental geology, and be available as a reference for all students.

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